REPORT
ON THE
MEASURES TO BE ATTENDED TO
IN THE
SURVEY
OF A
LINE OF NAVIGATION,
FROM
NEWCASTLE UPON TYNE
TO THE
IRISH CHANNEL.

BY WILLIAM CHAPMAN, ENGINEER, M. R. I. A.

PUBLISHED BY ORDER OF THE
Northumberland Committee of Subſcribers to the Survey.

TO WHICH ARE ADDED,
All the Reports ſubſequent to the Survey,
AND THE ESTIMATES OF
Meſſrs JESSOP and CHAPMAN.

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GENTLEMEN,

IT is with pleaſure I ſit down, at your requeſt, to give my opinion on the ſubject of a Navigation that has long been a favourite object with me: As few works, I conceive, can be more conducive to the general good, than a communication between the German and Iriſh Seas, acroſs the narroweſt part of England,—in a work of this kind, much has to be conſidered; both as to the mode of communication, and *the collateral advantages that may be derived*, which are often greater than the prime object of purſuit; and which, by not having been attended to, I have ſeen, in various inſtances, irrecoverably loſt, or only to be regained by a great additional expenditure.

In a line from the River Tyne to Solway Firth, as in every line from ſea to ſea, there muſt conſequently be great aſcent and deſcent; and therefore a number of locks requiſite; between every two of which there obviouſly muſt be a level of Canal more or leſs long; and accordingly as each portion of this aſcent is ſooner or later acquired, it follows that each diſtinct level will be in a more or leſs different part of the country from where it otherwiſe would be, and may be attended with *advantages or circumſtances peculiar to itſelf*. In paſſing from one place to another, there generally is ſome particular portion of the tract obviouſly pointed out by the great features of the country; and which cannot be deviated from; as, in the preſent inſtance, the moſt inattentive obſerver muſt ſee that the ſummit of the Canal ſhould paſs through the flat ground between the deep vale of Glenwhelt and the river Irthing, from which ground the water runs to both ſeas; and by following on each ſide the regular line of deſcent, the object of communication would be obtained. But, as I have already ſuggeſted, there may be other things to be attended to, either of immediate or *future* moment; which, by being conſidered previouſly to the Survey, may ſave a great deal of labour and time. Before I advert to theſe circumſtances, it may be neceſſary to give ſome reaſons why I do not recommend the plan of following the bed of the rivers.

I allow that all Rivers are capable of being made navigable in ſome given degree; and I have frequently found it expedient to follow their beds, when attended with favourable circumſtances; but I muſt ſay, that ſuch a Navigation as the Tyne would admit of above the tide-way, would be ill ſuited to what ought to be the ſcale of the reſt of your Navigation:—that it would be expenſive from the great width of the River and nature of its bottom:—that it would be liable to great interruption from floods, and conſequently defeat all ideas of a regular communication:—that, from the impetuoſity of its torrent, which brings down not only gravel, but even ſtones, ſhoals would, after great floods, be frequently thrown up, where navigable water was before:—that to attempt to prevent this, by flaſh-weirs, or other means of confining the channel, in dry ſeaſons, would be attended with great charge:—that the expence of hauling againſt the ſtream,* would be very conſiderable—and, finally, that it would defeat many of the great objects that I hope to point out to you.

Having ſufficiently reprobated the idea of following the bed of the Tyne, it remains for me to ſpeak of the going occaſionally into it. This method would partake of the inconveniencies of making the River the chief line; becauſe you would be ſubject to great interruption and danger from floods; and muſt either be content to have the works totally overflowed; or muſt, at the upſtream entrance of every Canal that abuts upon the River, erect a guard-lock equal to the full riſe of the higheſt floods; which, with the expence of its accompanying weir, and of the raiſed trackway along the navigable ſhore, with the charges attendant on keeping dry the foundation of every lock aſcending from the River, would be very coſtly. Therefore, as there are ſteep points on the verge of the Tyne, which would be difficult to cut through and protect, it follows, that were there no other reaſon, its immediate border is not the line to be purſued.

In a Canal of ſhort diſtance from ſea to ſea, two ſpecies of Navigation have to be conſidered: The one is, to adopt dimenſions ſuited to ſmall ſea-veſſels;† as has been done between the Friths of Forth and Clyde, and acroſs the Peninſula of Jutland, from the River Eyder, at Rendſburg, to the Belt, or Weſtern extremity of the Baltic, near Kiel: The other is, to follow ſuch a plan for a boat-navigation as ſhall be beſt ſuited to the length and local circumſtances of the country to be paſſed through. The firſt method is unadviſable; not only on account of the great increaſe of expence; but becauſe in this particular inſtance, it would leſs materially promote the purpoſes of commerce, from there being already a ſhorter paſſage between the two ſeas; and that, even had this not been the caſe, local advantages render it leſs neceſſary with you. What I allude to is, that from the exports of Newcaſtle being infinitely beyond its imports, innumerable veſſels return in ballaſt, from various places; from many of which, articles that go North or South about this iſland, would be brought at a trivial charge: and alſo, from the ſuperior magnitude of veſſels going from this port, to what thoſe would be that could croſs the kingdom, ſuch a reduction of ſea-freight would take place as to cauſe, in many inſtances, the alternate‡ conveyance by ſhips and boats to be ſo little more coſtly than the other, as to become an immaterial object in articles of value. On the other hand, cumbrous articles of ſmall value, ſuch as timber, &c. cannot be expected to croſs by the Canal *to be re-ſhipped;* nor would they even croſs the kingdom if the Navigation were made for ſea-veſſels, becauſe it never could be done for veſſels of that magnitude ſuited to carry *heavy articles at a ſmall freight;* which is abſolutely requiſite wherever the freight or expence of carriage conſtitutes any conſiderable portion of their value at the place of their delivery. The reaſons in favour of the tranſit of any articles will never have their full force, unleſs the Weſtern extremity of the line be terminated at ſome port ſimilarly circumſtanced with Newcaſtle.

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* This would have to be ſubmitted to; becauſe the throwing the river into a ſeries of ſtill pools, by a ſucceſſion of locks and weirs, would be far more expenſive than purſuing the land.

† The Forth and Clyde Navigation admits veſſels of nearly 20 feet beam and 8 feet draught of water, and of about 63 feet extreme length: in which laſt dimenſion it has been too much limited; owing, probably, to the fear of want of water, ariſing from the waſte that would take place in admitting ſuch ſmall veſſels as were ready ſuited for the paſſage.

‡ The chief objection to alternate conveyance is the difficulty on whom to affix any damage that may ariſe to valuable articles; and alſo in ſome inſtances the neceſſity of an intermediate conſignment.

Many of your purpoſes will be anſwered by falling into the head of Solway Firth, at or near Sandsfield; but as the Navigation, even to Bowneſs, or Allen-water foot, (between which and Sandsfield would be inconvenient to the Canal boats) is very difficult, and no veſſels would come there but for the expreſs purpoſe of bringing or taking away articles to paſs by the Canal, I feel myſelf inclined to recommend that it ſhould fall into the ſea at Maryport; which, although it would lengthen the line about two or three and twenty miles, would *not very eſſentially increaſe the expence*, as no more locks would be requiſite in one inſtance than the other. Of conſequence, in point of emolument to the Subſcribers, this part would be the moſt productive, excluſive of its bringing in a greater diſtrict of country, and including the town of Wigton within the general advantages.

The facility of communication with both ſeas, and various intermediate parts of the kingdom, (which will hereafter be pointed out) may probably cauſe new manufactures to ariſe at the already flouriſhing town of Carliſle, and at Hexham, Brampton, and other interior places, where at preſent there may not be full employment for the people. And as to Newcaſtle and its vicinity, which abound with fabrications of heavy articles, ſuch as ſteel, white-lead, various implements and utenſils of hammered and caſt iron, &c. and with extenſive works of earthen-ware, glaſs, and other bulky, but valuable commodities, it is ſelf-apparent that great advantages muſt ariſe to the manufacturers, to the public, and to the proprietors of the propoſed Canal, from having an eaſy and expeditious communication with a port on the Iriſh Channel.

The imports from Ireland will be beef, pork, raw hides, rape ſeed, &c. from Dublin; oats from Drogheda, Youghall, and Limerick; beſides articles of leſſer weight, as linen, &c. from Belfaſt, Newry, and Londonderry;—all of which coming in light colliers, will be brought at ſo low a charge as often to occaſion, in war time, or in winter, the tranſit of many articles acroſs the kingdom, to be afterwards tranſported to other Eaſtern ports. A cauſe ſtrongly operating on which will be, the lowneſs of freight from Newcaſtle, as already mentioned, and the perpetual opportunities of ſending *to every port, to which coals are ſent*, any portion of a cargo of merchandiſe; ſo as of courſe to occaſion much greater expedition, and enable the merchant to turn his capital the oftener: the advantage of which, and of reduced inſurance in time of war, would, *in articles of value*, be equivalent to a conſiderable additional charge of freight; but in all inſtances, where full cargoes are not wanted to the different ports, the freight will be cheaper than importing by the medium of London, and in ſmall traders from thence.

It now remains to be mentioned where the Canal ought to fall into the tide-way at its Eaſtern extremity. Lemington has been ſpoken of with a great deal of propriety, as the river runs from thence downwards in nearly a ſtreight courſe, and is navigable every tide;—but to me there are conſiderable objections. The firſt is, that the long and *ſlight* craft, beſt ſuited for Canals, would conſtantly meet with damage from the great concourſe of keels, both in their paſſage to and from Newcaſtle, and during their loading and delivery, either to the ſhore, or to and from ſhips. My other objection is, that a great ſource of revenue would be loſt that would otherwiſe ariſe from market and paſſage-boats. To enable you to judge of what this may be, I ſhall give you an example from another kingdom:—The groſs annual revenue of the paſſage-boats to and from Dublin to Monaſtereven, a diſtance of forty-one Engliſh miles, is about fourteen thouſand pounds. I am far from ſuppoſing that your whole diſtance will give you as much as that I have mentioned from the Iriſh Capital, along the great Weſt road; but, when I conſider that the latter is greatly retarded in its effect, *by the interruption ariſing from the paſſage through eighteen ſingle, and ſix double locks, in that ſhort ſpace;* and that, from fortunate local circumſtances, you have it in your power *to avoid moſt of the inconveniencies ariſing from aſcent and deſcent*, I think you may fairly eſtimate on a *net* revenue of two thouſand pounds a year, excluſive of what may be derived from covered market-boats.* The local advantage I principally allude to, is the great riſe of the North part of Newcaſtle above the level of the river; which gives an opportunity of the paſſage and market-boats † ſtarting on a level approximating that of the ſummit of the Canal; at leaſt of extending, in all probability, beyond Hexham, which will give a decided advantage both in the eaſe and expedition of the ſpecies of communication in queſtion.

From the Northern extremity of Newcaſtle, viz. from behind Gallowgate, I would propoſe the Canal to be continued, ‡ ſkirting the town, to Ouſeburn. And to enable veſſels to be loaded or diſcharged by the Canal boats, without danger from the latter being damaged by keels, or ſtrained by lying aground, I would adviſe a wet dock, capable of containing about twenty veſſels, to be made in the flat ground upon Ouſeburn, above the Shields-road bridge. To accompliſh this, it would be requiſite to ſtreighten the courſe of the bourn; and to make draw-bridges at the Glaſs-houſe and Shields roads:—Alſo, to ſave the expence of much excavation, it will be neceſſary to place the level of the baſon above that of high water, and to enter it by a ſhip-lock.—— On the completion of theſe works, Newcaſtle would be a Peninſula, *and have water communication to every avenue.* The part of the Canal ſo far ſurrounding it ſhould of courſe be as near the preſent buildings as poſſible; and ſo laid out as to be coincident with future ſtreets and quays, in the moſt advantageous poſition for the regular increaſe of the town.

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* This muſt be *very conſiderable*, as the country people from Hexham, Corbridge, Bywell, Ovington, Ovingham, Wylam, &c. may, by this means, travel to Newcaſtle, *without taking their horſes from the work of their farms, or being at the expence of keeping them in town.* They will alſo go without expoſure to the inclemency of the weather, and more expeditiouſly than they otherwiſe would, with the articles they carry.—This, on the Newcaſtle end, ſhould produce as much as the paſſage-boats are eſtimated at. And other towns will be in a leſſer degree productive.

† On the Dublin Canal they are precluded from market-boats, on account of the delay and waſte of water in paſſing the numerous locks near the city.

‡ This part of the Canal, and even all to the Eaſtward of the Carliſle road, may be left to the laſt, as being *expenſive from the number of locks and other cauſes.* A temporary land-carriage to the river muſt, of courſe, be ſubmitted to in the beginning; and the firſt part of the Canal to be executed, *as being immediately productive of revenue*, ſhould be the level towards Hexham from the Weſtgate turnpike-road; or at fartheſt from its Eaſtern extremity behind Gallowgate and Percy-ſtreet.

The great leading features being now pointed out, it becomes neceſſary to attend to what advantages may be obtained by departing from the ſimple object of gradual deſcent, and ſtreightneſs of line towards each end; and which probably may not militate againſt the latter.

The great ſource of revenue in Canals, although not without exception, is the carriage of heavy articles; ſuch as coals, limeſtone, flags, ſlates, iron-ſtone, &c. The projected line will, in this inſtance, have its ſhare of advantages; as at the Eaſtern end, lime-ſtone will be brought from Corbridge and its vicinity; or from the borders of the North Tyne: and very probably, from the abundance of iron ore near the line, blaſt furnaces, which require *both* the laſt mentioned articles, will be erected in ſituations abounding with coals ſuited for ſuch works.

Towards the Weſtern extremity, the city of Carliſle will draw great quantities of coal and lime a conſiderable diſtance on the Canal. And as to ſlates, I flatter myſelf they are alſo within your reach; as I was informed at Shap, (in the county of Weſtmorland) that about ſix miles Weſtward of it, at Moſedale, there are excellent quarries of that article. I am unacquainted with the preciſe poſition of Moſedale, but I conceive it to be one of the dales adjoining Ulles-water.—The future acceſs to this lake, and various attendant advantages, are much more in your power than may at firſt occur: it requires only the not departing from the level of your ſummit, in going Weſtward, until you arrive at the firſt opening, where this level may be continued Southward up the vale of the Eden. This point, I ſuppoſe, will be a little Eaſtward of the town of Brampton; and, in all probability, the Canal may continue without a lock to beyond Kirkoſwald; but abſolutely how far, it is impoſſible for me now to ſay:—I can only aſſert, that the Canal muſt paſs up the vale of the Emont, and within a very ſhort diſtance of Penrith; and, that if circumſtances any way *render it neceſſary*, there can be no impropriety in following the bed of the Emont, above its junction with the Lowther; becauſe the former river riſing out of a ſpacious lake, can not *be ſubject to ſudden or extreme fluctuations* of riſe and fall, on account of the mountain torrents being equalized by the flow and progreſſive riſe and fall of the lake, and alſo from its ſerving as a ceſspool to collect and retain the ſtones and gravel that would otherwiſe interrupt or impede the Navigation of the river.

The probable line of Canal from near Brampton to Emont-Bridge, Weſt of Penrith, would be about twenty three miles; and from thence to Ulles-water, about five miles; after which, there would be a free navigation of ſeven or eight miles in the boſom of mountains abounding with ſlates of the firſt quality in Europe; the carriage of which alone along the lines Eaſt and Weſt I leave to yourſelves to eſtimate. This would not be the ſole advantage:—The town of Penrith is commercially of no inconſiderable moment;—the ſupplying it with coals would occaſion a conſiderable carriage on the Canal; and the paſſage-boat communication to the Lakes, and towards Kendal, Appleby, &c. would be with little interruption of locks, and of no trivial conſequence; in addition to which, the trade, with the commercial town of Kendal, in both raw and manufactured articles, I am inclined to think, would conſiderable. The diſtance, by the high-road through Shap to Emont-Bridge, is twenty-five miles; but by a new road that probably may take place up the vale of one of the branches of the river Ken; and thence by an exiſting high-road, to the head of Ulles-water, the diſtance might be ſhortened many miles, and the repeated heavy aſcents and deſcents on the preſent road be avoided. The time alſo may arrive, when ſome ſpecies of water-communication may be adopted.

I have not even yet enumerated all the advantages that muſt eventually be derived from this line; the chief of which is, that by departing from *ſuch height of the Canal* as is at leaſt coincident with its paſſage by the bridge, already mentioned, over the Emont, a branch may be carried, without a lock, a conſiderable way up the vale of the Eden, towards Appleby, and the Eaſt of Weſtmorland.

Having traced the Weſtern line from the ſummit, to as far as Brampton, the next conſideration is, to approach Carliſle *on as high a level as poſſible;* which, *if particular circumſtances do not prevent*, will be on the brow of Stanwix-hill;[*] from whence it may continue down to the Eden-ſide, to where the ground on both ſhores is higheſt, and beſt ſuited to paſs towards Maryport. It is neceſſary to paſs the Eden with a conſiderable elevation above the level of the ſea, as without doing ſo, the line could not approach near Wigton, nor could it be conducted towards Maryport, in any tolerably ſtreight courſe; as want of height ſufficient to paſs the intervening country, would throw the line near the ſea-coaſt. As to any further *general principles* to be attended to, in laying out this portion of the Canal, *(for the minutiæ or diverſities of the intervening parts, can only be aſcertained by a judiciouſly directed ſurvey)* I can only ſay, that the river Ellen ſhould be approached on as high a level as it conveniently can; ſo as to admit (if the line of the country allow it) of carrying a branch to Cockermouth, without locks: Which event, if eaſily practicable, muſt, ſooner or later, take place.

Having now traced the Canal and its branches from the ſummit Weſtward, I ſhall return to the Eaſtern part of the line, proceeding from the ſummit under Glenwhelt; from which I would propoſe, if no particular difficulties intervene, to purſue the level to near the banks of the North Tyne; and there to deſcend, as far as requiſite, to meet the propoſed level from behind Gallowgate; which, if not too low for paſſing ſome of the ſteep grounds Eaſt of Corbridge, ſhould croſs the North Tyne.

This level ſhould, at Newcaſtle, commence at the height *moſt convenient to avoid* the buildings to the Weſt of the Ponteland Road; and will of courſe proceed above the new baths, and onwards under Benwell.——With what circuity or ſtreightneſs of courſe it will proceed Weſtward, I cannot poſitively ſay; but I conceive there is no material difficulty, excepting between Bywell and Corbridge (where a ſteep headland projecting to the river may occaſion ſome deep cutting) unleſs what naturally ariſes from carrying a Canal on the face of a ſteeply declining country, which will operate principally on what *would otherwiſe be the eligible width.* The level mentioned will, I ſuppoſe, paſs above Newburn, Cloſe-houſe, Wylam, Ovingham, Bywell, and Corbridge, and conſiderably under Beaufront.

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[*] The propriety of keeping on this ſide of Carliſle, or the other, will depend on the *neceſſity of elevation in going Weſtward from Carliſle*, and *the conſequence that may be attached to paſſage-boats and market-boats*, both of which require the leaſt poſſible interruption from locks. If ſufficient elevation can be obtained on the South-ſide of Carliſle, that ſide will of courſe claim the preference. It likewiſe, if the Eden *fall gently below Carliſle*, may be worthy of conſideration, how far it would be eligible to make a Navigation thither from Solway Firth, for ſea-veſſels of about 80 or 100 tons, either through the Haughs, or in the river, as circumſtances may point out, in place of the other projected lines.—Much of the eligibility of this will depend on how far the Navigation of the Firth can be eaſily improved.

Had the vale of the river Pont been low enough, a line might have gone through a flatter country, with more or leſs circuity, from the Town-Moor towards Stamfordham; and ſo onwards by Erring-burn to the North Tyne; but excluſive of this courſe being, as far as my eye can judge, too high, it would both conſiderably lengthen the diſtance, and paſs too far from Hexham.

The chief collateral object on this part of the line will be to facilitate the carriage to and from the lead country. This may be advantageouſly effected by departing from the ſummit level at Glenwhelt, with a branch Canal on a ſmall ſcale, ſkirting the Weſt ſide of the vale of the South Tyne, which will run a very conſiderable diſtance without a lock; probably to near Knareſdale, or between it and Kirkhaugh.—The next conſideration will then be, to find ſome elevation that will be ſuitable to a line * running Eaſtward and Southward; but neceſſarily winding up the vales the whole length of the lead country, and as near the Mines as may be, conſiſtently with as moderate an aſcent as poſſible from the branch on the ſummit level. The nature of the article to be carried, does not require, and the peculiar circumſtances of the country to be gone through, do not eaſily admit of the ſame ſcale of magnitude, as that I would recommend from ſea to ſea, which ought to be ſuited to boats of about fifty tons or upwards, both to render the carriage cheaper, and to paſs in any given time a greater quantity of tonnage through the locks.

If it were eaſily admiſſible, a width of lock from fourteen to fifteen feet would be eligible; but from the ſteep declivity of a large portion of the ground that the Canal will have to paſs through, I am inclined to think that it will be adviſeable to be content with twelve feet width of boat; which, as they may draw at leaſt four feet, and be ſixty or ſixty-five † feet long, may be conſtructed to carry fifty tons. To make a Canal of this magnitude to and through the lead country, would be extremely expenſive as well as unneceſſary.

On the face of a mountainous country, where there are ſudden bends and little ſoil, boats, from the firſt cauſe, ought not to be long; and, from the thinneſs of ſoil and declivity of the ground, the Canal would be expenſive to be either wide or deep. Bridges alſo would be coſtly; not only from the expence of their erection, but the difficulty of filling their approaches on the downward ſide: I therefore recommend a

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* If the nature of the country admit of it, this line ſhould be on one continued level, but various circumſtances may render it eligible to gain the aſcent progreſſively.

† Unleſs the Canal have various ſudden bends, the boats may, with propriety, be longer.

Canal of only three feet ſix inches depth; and at every high or by road, that there be a paved ford of two feet nine inches depth, and the downward ſide of the ford to be an overflow, ſo that the water can never riſe materially higher, and horſes and carriages may at all times ſafely paſs. The width and length of boats on this Navigation I would adviſe to be half of what they will be on the main Canal; ſo that, if found more eligible than re-ſhipping their cargoes into the large boats, four of the ſmall ones may proceed together, and paſs through the locks with the leaſt waſte of water, that the ſeparate plans will admit of — Theſe boats ſhould be of the conſtruction of the Birmingham trows, (upright ſided and flat-bottomed) and when light, ſhould only draw about ſix inches water: they will then, at thirty-two feet length and ſix[*] feet width, carry, according to the form of their ends, from eight to ten tons each, when loaden to two feet ſix inches; and four of them, which may be navigated with one horſe and four boys,[†] will, at the leſſer quantity, carry thirty-two tons. Theſe boats ſhould be connected together in pairs; each hind one, as in the Lincolnſhire Navigations, acting as a rudder to the fore one; in each of which, from a ſmall maſt, a light track line may go to the ſwingle-tree of the horſe.

In deſcending from the line running through the lead country, which probably may be conſiderably higher than the branch from the ſummit of the main Canal, various meaſures may be adopted; either paſſing the boats down inclined planes, as at Coalbrook-Dale; or perpendicularly,[‡] if the advantage of a precipice can be obtained; in each caſe a deſcending boat drawing up an aſcending one: or by ſimple means of diſcharging the cargoes of the *boats of one level* into *thoſe of another*. But if water be to be had, as I hope it may, I would recommend locks of a rude and eaſy conſtruction; which I ſuppoſe may be executed at nearly as little expence as the inclined plains and requiſite machinery, and not ſo liable to accidents and miſmanagement.

This Navigation, I conceive, will be moſt eligible to be executed by the Proprietors, or parties intereſted in the Lead Mines, by ſums advanced by way of loan; the intereſt of which, and annual charges, to be paid by a rate on the lead; which will aſſure to each Company the carriage of their produce at the leaſt poſſible coſt; which by way of toll upon the diſtance would on ſome of them come too high, from the circuity of the courſe to Newcaſtle; *although the ſimple carriage upon the Canal would not materially operate.* For example: The boats may fairly be admitted to travel twenty miles a day; and then, allowing no advantage for back-carriage, ten miles will be a day's work; the expences on which I think will ſcarcely exceed what I ſtate below, viz.—

The maintenance of a horſe per day — —	2	6
Four ſtout boys, at 1s. 6d. — — —	6	0
Wear and tear of the boats, &c. — —	2	6
In all	11	0

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[*] If, upon examination, locks of 14 or of 15 feet width be adopted, the width and burthen of theſe ſmall boats may conſequently be increaſed.

[†] A driver, two ſteerers, and one to manage the ſtop-ropes in going into a lock.

[‡] Similar in the leading features to the plan ingeniouſly ſuggeſted by Dr James Anderſon, in one of his late publications.

Which, on the carriage of thirty-two tons for ten miles, is ſhort of a half-penny[*] per ton per mile; and therefore the circuity of courſe of this mountain Canal is no material object; and it conſequently may, unleſs very unfavourable circumſtances prevent, extend towards the mines of Stanhope, in Weardale; and as far onwards, round the mountains, as the intereſts of the country may require.

A ſimilar Canal to what I have mentioned may, at ſome future period, wind up the vales of the North Tyne and Reed water; which induced me to recommend *the continuance Eaſtward of the ſummit level, to near the North Tyne*, as then this purpoſe may be obtained with the leaſt poſſible aſcent; and, at the ſame time, increaſed ſupplies[†] of water be brought into the ſummit; which of itſelf is of great moment, and one of the leading reaſons that induced me to recommend the extenſion of the ſummit level in ſuch a manner as to fall in with the chief branches: for then (as they will be all aſcending) let the trade increaſe on them as much as it may, the boats muſt bring with them *all the water requiſite to paſs them onwards*, whether they proceed towards the Eaſt or the Weſt; whereas, were they to communicate even only one level below the ſummit, they muſt, *in all the portion of their trade that ſhould paſs the ſummit level*, conſume two lock-fulls for every boat.

So far as relates to the ſmall boats propoſed to go in fleets of four together, they will jointly conſume the ſame quantity of water in paſſing ſeparately through one of their own ſingle locks, as they will by paſſing collected through one of the large ones on the main trunk; and in aſcending the ſmall locks, *of more than one fall*, they will have a decided advantage by being in fleets, both from ſaving in water and time, which latter will equally operate in deſcending.

It probably may be demanded why the ſyſtem of the ſmall Navigation ſhould not be adoptad on the main trunk, and throughout the whole?—The objections that occur to me are various:—

1ſt. A very extenſive quantity of tonnage could not be paſſed through the locks; at leaſt any caſual delay for a few hours in any day would retard many of the boats until the next.

2dly. The quantity of water conſumed would be much greater: as

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[*] I do not mean to infer, that the *charge of conveying* lead or other articles to Newcaſtle, or elſewhere, will be ſhort of a halfpenny per ton per mile; becauſe the delays in loading and delivery, and the time waiting for a cargo, are to be taken into account; but *ſo far as relates to increaſe of diſtance*, my aſſertion obviouſly may be juſt; and it is therefore apparent, that the further any Canal or Navigation is extended, the cheaper may any article be carried by the ton per mile, and the more *diſtance laterally* will its benefits be extended; becauſe the *charges of conveyance to and from, and taking in and out of the boats*, have to be equallized upon the *diſtance of water carriage;* which, in ſhort ſpaces of it, amount ſo high as to render land carriage preferable, even near the banks of the Canal.

[†] Supplies of water for the ſummit will be obtained from the Irthing and the Tipple; and ſhould they, combined with thoſe mentioned, be inſufficient, *reſervoirs may be made in the adjacent vallies above the level*, to collect the water of floods and ſudden rains, ſo as to be fully adequate to any probable conſumption.

boats of a ſmall draught *conſume more water** in paſſing through the locks, *in proportion to their tonnage* than thoſe of greater depth, if in other things equal.

3dly. The ſmall boats would not be well ſuited for the carriage of large timber; neither without being decked, which would decreaſe their burthen, would they anſwer for periſhable or valuable goods, particularly if in ſmall packages.

4thly. On bulky and cheap articles the carriage would be ſenſibly heavier in a diſtance of fifty or ſixty miles.

5thly. It would be ill ſuited for paſſage and market boats.——And laſtly, although the ſaving would be great where ſmall regard is paid to diſtance, or the ground happens to be favourable, yet, in croſſing vallies, or cutting through hills, the difference of expence between one plan and the other would be inconſiderable.

It may alſo be ſaid, Why not adopt the ſhallow water, ſo as to ſubſtitute fords for bridges, and at the ſame time retain the width and breadth recommended for the large boats?—Several of the above ſtated objections will be found to militate againſt this plan, *and be more than equivalent to the ſaving of bridges and decreaſe of excavation.* The reſult I mean to draw is, that there is no ſuch thing as a general ſyſtem of Navigation univerſally eligible; but that every thing muſt bend or give way to local and incidental circumſtances, whether *of the face of the country*, or *the ſtate and particular articles of its commerce*, or the other Navigations that may immediately or eventually be communicated with.

I have now remarked on moſt of the collateral advantages that may, at more or leſs diſtant periods, be expected from previouſly attending to the moſt eligibie courſe for the Canal; and which, without ſuch attention, would (one alone expected) either be loſt; or only imperfectly obtained by a great additional expenditure. What the expence of carrying this extenſive plan into effect will be, it is impoſſible to ſay, until after a ſurvey: but from the abundance of excellent building ſtone throughout the line for the different locks, aqueducts, and bridges, and of limeſtone, in particular places, which may be conveyed by water to others; and alſo of oak timber, for the lock gates and other purpoſes; I ſhould ſuppoſe the main trunk, although there are ſeveral difficulties, may probably average about three thouſand pounds a mile.

A conſiderable part of the income of the Canal will ariſe from the circumſtance of its departing from the height of the North part of Newcaſtle,

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[*] The draught of water of light Caual boats, whether the navigable water be 6 feet or 4 feet, will, if of a ſimilar couſtruction, be not materially different: therefore, the quantity of burthen, or the difference between the light and loaden draught; will decreaſe more rapidly than the proportionate depth of water the boats can be permitted to draw: and as all boats, let their burthen be what they may, muſt conſume two lock-fulls of water in paſſing a ſummit level, it becomes eligible in lock Navigations not to have too ſcanty a depth. In deſcending, the large boats conſume leſs water than the ſmall:—becauſe the quantity is leſſened by the bulk of the boat, which is diſplaced on entering the chamber of the lock: but this is compenſated for, in aſcending, by the lock-full of water being increaſed by the quantity that paſſes into the chamber to occupy the ſpace of the boat on its entering the upper Level.

caſtle, in place of aſcending from the river at Newburn or Lemington. —Other advantages will likewiſe be found from bringing the Canal in this line; which I ſhall not now take up your time to explain: You will permit me, however, to congratulate you, that the Gentlemen of the Northern counties are at length awake to the advantages that are to be derived from interior Navigations; and to ſay, at the ſame time, that all the towns, within the influence of theſe projected Canals, will be increaſed, and the lands raiſed in value: that Newcaſtle, from the concurrence of favourable circumſtances, muſt become the Emporium of the North of England, and greatly increaſe its bounds; and alſo be ſtill better ſupplied with every neceſſary of life than at preſent; from the eaſy and rapid communication that will be afforded to the Farmers by Canals *uninterrupted by numerous locks*. It owes *this advantage to its great riſe above the level of the Tyne;* and its oppoſite ſuburb may at ſome period avail itſelf of its ſimilar local circumſtance; as a Canal may eaſily run *from the higher part of Gateſhead, by Cheſter le ſtreet, to Durham*; and, probably, much higher up the Vale of the Wear towards Biſhop Auckland, ſo as to draw off the heavy produce of that country, and return the foreign imports neceſſary for its conſumption. The inconvenience ariſing from its not communicating with the Tyne, would only be of a ſecondary nature, as moſt of the articles, either of import or export, would have to be ſtored before they were ſhipped, either in Canal boats, or on board trading veſſels. In this predicament it would be preciſely as the Canal to Liverpool is at preſent, and as the grand Canal to Dublin has hitherto been.

I ſhall be happy if any of the ideas I have ſuggeſted redound to the benefit of this country; and, I am, very ſincerely and reſpectfully,

GENTLEMEN,

Your obedient humble Servant,

William Chapman.

NEWCASTLE, *Jan. 5th*, 1795.

To the Gentlemen delegated from the Committees
of Northumberland and Cumberland.

P. S. It has been ſuggeſted that there is a paſs between the rivers South-Tyne and Eden, to the South of that between the Tipple and Irthing, by Glenwhelt, viz:—From Hartley-burn to Gelt river, which paſſage would ſhorten the line, and paſs cloſe by the Collieries in that quarter. *If theſe objects can be obtained without aſcending to a higher level*, it would be a deſirable circumſtance; *and, if not*, the Collieries may eaſily communicate with the ſummit level of the other line, by a rail-way.

REPORT